

**Valley Clean Air Now Tune In & Tune Up Program Events
at
Visalia, Merced, Fresno, and Modesto, California
2006 – 2007**

Sponsored by Valley Clean Air Now

**With Assistance from
The Advanced Transportation Technology and Energy Initiative**

April 17, 2009

INTRODUCTION

This is the fifth in a series of reports describing the Valley Clean Air Now (CAN) Tune In & Tune Up (TI&TU) Program, which is designed to quickly screen and to identify high-emitting vehicles in need of emissions-reducing repairs. Relationships established between Valley CAN, the Advanced Transportation Technology and Energy Initiative (ATTEi), and the California State Bureau of Automotive Repair (BAR) contributed to the program's success.

This report describes TI&TU events in the cities of Visalia, Merced, Fresno, and Modesto, between October 2006 and October 2007. It summarizes all the data collected from the TI&TU events in held in each of these cities, with additional detail on vehicle characteristics in the Fresno 2007 event. With the assistance of media buys on English and Spanish radio stations and a comprehensive grassroots outreach campaign, a total of 1124 vehicle owners volunteered to have their vehicles tested in the four events.

In the October 2006 Visalia event, remote sensing devices operated by BAR staff were used to identify potentially high-emitting vehicles in need of repairs. The remote sensing high emitter cutpoints for CO, HC, and NO_x were 5%, 1000 ppm, and 1000 ppm, respectively. If any vehicle's exhaust emissions exceeded any of these pollutant cutpoints, the vehicle was eligible for participation in the Visalia event.

During the Merced, Fresno, and Modesto 2007 events, vehicles were given a tailpipe emissions test using a hand-held portable emission testing device, performed by staff from BAR. Candidate vehicles were tested for exhaust hydrocarbons (HC) and carbon monoxide (CO) during the two-speed idle test using the AutoLogic Model 310-0121 gas analyzer. Because the vehicles were tested under idle conditions, no measurements of nitrogen oxides (NO_x) were made during those TI&TU events. If the vehicle failed any of the two-speed idle cutpoints for HC or CO exhaust emissions or a quick visual inspection for tampering or illumination of the check engine light by BAR staff, the vehicle was judged to be eligible to enter the Valley CAN vehicle repair program.

TI&TU program staff provided repair vouchers worth up to \$500 in emission-related repair costs to the owners of vehicles that failed the remote sensing or tailpipe emissions test. Data from the four TI&TU events are shown in Table 1. Five hundred forty-two vehicles began the repair portion of the program. Vehicle repairs were performed at designated Gold Shield Certified repair facilities in the four cities.

If an inspected vehicle failed the tailpipe emissions test or visual inspection, the vehicle's owner was directed to an on-site diagnostic testing station at each event where automotive students, supervised by their instructors from the respective community colleges, performed a basic under-hood visual inspection and provided written information regarding possible causes of their vehicle's emission problems. These events provide a career technical education opportunity as each student has the opportunity to assess dozens of cars with a wide variety of potential problems.

To summarize, the vehicles go through the following process:

- Arrive at the event and queue up to await testing
- Proceed to the emissions testing station, where BAR staff perform a two-speed idle emissions test with a portable gas analyzer
- Continue to the under-hood diagnostics station, where automotive students perform a basic visual inspection
- If the vehicle fails the on-site inspection or emissions test, the owner schedules an appointment with a Gold Shield test-and-repair shop before leaving the event.

Emissions benefits generated by the private Tune In & Tune Up program are not included in the Smog Check baseline credits for emissions or in SIP calculations.

This report describes only the tailpipe emissions reductions measured from this set of vehicles, and may not be a sample representative of the on-road fleet. Results might vary due to different methods of emission reduction calculations.

Table 1. Tune In & Tune Up Event Data

Location/ Date	Vehicles Tested	Coupons Distributed/ Redeemed	Percent Redeemed	Valley CAN Inspection/Repair Costs	Customer- Paid Costs	Total Repair Costs
Visalia October 21, 2006	253	170/93	55%	\$38,920	\$7,872	\$46,792
Merced April 21, 2007	275	202/148	73%	\$56,083	\$11,678	\$67,761
Fresno September 15, 2007	351	229/171	75%	\$52,360	\$14,680	\$67,040
Modesto October 20, 2007	245	132/105	80%	\$35,663	\$5,976	\$41,639
Totals	1124	733/517	- -	\$183,026	\$40,206	\$223,232
Average per Event	281	183/129	71%	\$45,757	\$10,052	\$55,808

The following sections describe data collected and emission reductions obtained from the TI&TU events in Visalia, Merced, Fresno, and Modesto in 2006 and 2007.

VEHICLE AND REPAIR DATA

Five hundred forty-two vehicles began the repair program, where vehicles were first given a confirmatory California Smog Check test and inspection at the participating Gold Shield Smog Check shops in the four cities. There were several outcomes from all the vehicles that participated, as shown in Figure 1.

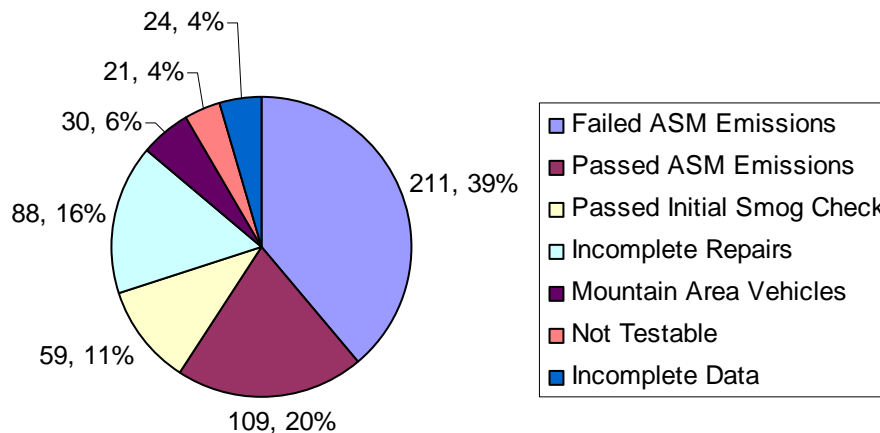


Figure 1. Number and percentage of vehicles categorized by emissions testing outcomes.

A total of 320 vehicles (211 plus 109 vehicles) were successfully repaired per industry standard practice to Smog Check inspection standards and emissions cutpoints. Of that number, 34% or 109 vehicles, passed the ASM emissions portion of the Smog Check at the repair station but failed the Smog Check inspection because of other reasons. Eighty-nine percent of the vehicles that failed the initial screening test at the TI&TU event also failed the ASM inspection at the repair shops. This variance is due to the at-event screening and Smog Check testing being done with different types of equipment as well as the variability of emissions levels from malfunctioning vehicles. Sixteen percent of the vehicles (a total of 88) left the TI&TU Program before complete repairs were made, with the majority of those owners not wanting to spend their own money on repairs costing more than the \$500 repair voucher provided by the Valley CAN Program. Six percent of the vehicles were registered outside the program areas, and did not require NOx-related emission repairs. Twenty-one of the vehicles (4%) were in such poor condition that the repair shops did not feel that they were repairable, and there were incomplete repair/emissions data for another 24 vehicles.

The model year distribution of all vehicles participating in the program is shown in Figure 2. Vehicles were given both emissions tests used in the enhanced Smog Check program, the ASM5015 and the ASM2525, which are steady-state loaded mode tests conducted on a dynamometer. All vehicles in the “Passed ASM Emissions” and “Failed ASM Emissions” categories were successfully repaired according to Smog Check program criteria. The average model year participating in the program was 1991, and the median model year was 1992. The newest model year vehicles in the program that failed the initial Smog Check inspection tended to fail more for other reasons than the ASM emission cutpoints, as depicted in Figure 2. Table 2 provides the status of the vehicles that entered the repair program and their average repair costs in the four events.

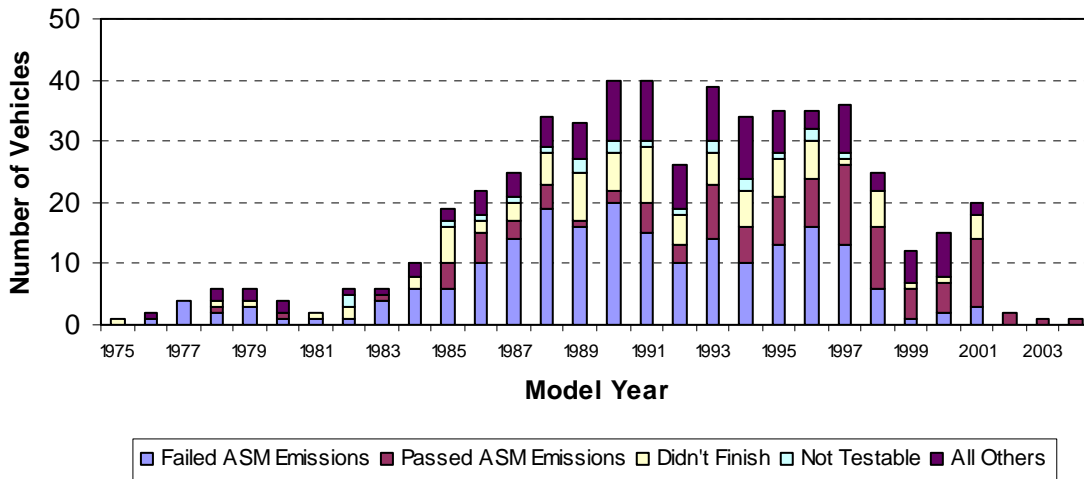


Figure 2. Model year distribution of the vehicles participating in the 2006 Visalia and 2007 Merced, Fresno, and Modesto Tune In & Tune Up Events.

Table 2. Status of vehicles that entered the 2006 Visalia and 2007 Merced, Fresno, and Modesto TI&TU Repair Program Events.

Vehicle Category	Average Repair/Diagnosis Cost/Vehicle
Successfully repaired, n = 320	\$547
Failed ASM Emissions and Repaired, n = 211	\$574
Passed ASM Emissions and Repaired, n = 109	\$496
Incomplete Repairs, n = 88	\$300
No NOx requirements, n = 30	\$398
Not testable, n = 21	- - -
Incomplete Data, n = 24	\$433
Vehicle passed Smog Check = 59	\$65

There were 320 vehicles that initially failed the initial screening test were successfully repaired according to Smog Check criteria. However, 211 or 66% of those vehicles that failed the initial inspection failed the test due to emissions failures during the ASM tests. The remaining 109 vehicles that failed the initial Smog Check inspection failed for reasons other than tailpipe emissions failures during ASM testing, which were categorized as visual or functional failures, such as illumination of the malfunction indicator light (MIL). The average repair cost for all the successfully-repaired vehicles was \$547; the minimum cost was \$98, and the maximum repair cost was \$1955. Repair expenses exceeded the \$500 voucher amount for 164 vehicles. An additional 88 vehicles were partially repaired, but for a number of reasons, their repairs were not completed according to Smog Check criteria. The average cost of partial repairs for this group was \$300. Thirty additional vehicles were repaired according to Smog Check criteria, but because they were registered outside the four cities, there were no Smog Check emission standards for nitrogen oxides (NOx); the data for this group of vehicles are incomplete and/or questionable in some cases.

Twenty-one vehicles were in such bad state of maintenance that they were judged by the repairs shops as not testable. Fifty-nine, or 11% of the vehicles that failed the BAR emissions test during the four TI&TU events passed the initial Smog Check at the repair shops.

SMOG CHECK EMISSION REDUCTIONS

Table 3 summarizes the pre- and post-ASM emissions data for the 320 vehicles that were successfully repaired according to Smog Check criteria for those individual vehicles. The values shown in the table are the average of the ASM5015 and ASM2525 emission tests. Based on the results of this vehicle sample, emission reductions of 85%, 68%, and 70% were achieved for CO, HC, and NOx, respectively, for the successfully-repaired group of vehicles. Again, these results are specific to this vehicle sample (many of which are unregistered) and should not be extrapolated statewide without further analysis.

Table 3. Pre- and post-repair emissions data for the 2006 Visalia and 2007 Merced, Fresno, and Modesto TI&TU vehicles.

Vehicle Class	Ave. Before-Repair ASM Emissions			Ave. After-Repair ASM Emissions		
	CO, %	HC, ppm	NOx, ppm	CO, %	HC, ppm	NOx, ppm
Successfully repaired, n = 320	0.87	130	724	0.13	41	219
Failed ASM Emissions and Repaired, n = 211	1.26	177	972	0.13	45	244
Passed ASM Emissions and Repaired, n = 109	0.12	40	244	0.14	35	171
Partial repairs/Left program, n = 88	1.55	271	812	--	--	--
No NOx requirements, n = 30*	0.64	79	--	--	--	--
Not testable, n = 21	--	--	--	--	--	--

*Data incomplete and/or questionable for these vehicles.

Also shown above are pre-repair average ASM readings for the vehicles in each subgroup, where emissions data were available. Notable are the higher average pre-repair CO and HC emissions for the 88 vehicles for which the motorists chose not to participate fully in the TI&TU repair event. Had these vehicles been repaired according to Smog Check criteria, the total emission reductions obtained in the program would have been significantly larger.

Figure 2 illustrates the average pre- and post-repair ASM emissions for the 211 vehicles that failed the pre-repair ASM emissions tests and were later successfully repaired according to Smog Check inspection and emissions standards, resulting in average ASM emission reductions for these events of 90, 75, and 75% for CO, HC, and NOx, respectively.

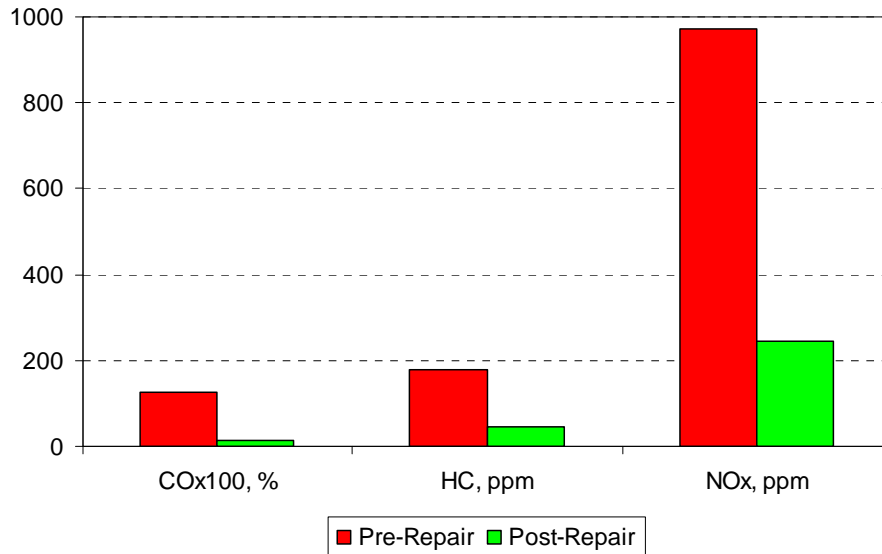


Figure 2. Pre- and post-repair average ASM emissions for the successfully-repaired 211 vehicles that failed the pre-repair ASM emission tests during the four TI&TU events.

Figure 3 displays the average pre- and post-repair ASM emissions for the 109 vehicles that passed the pre-repair ASM emissions tests and were later successfully repaired according to Smog Check criteria, resulting in an average ASM emission increase of 10% for CO and reductions of 13 and 30% for HC and NOx, respectively. Note that the vertical emissions scale in Figure 3 is the same as that in Figure 2 for comparison purposes.

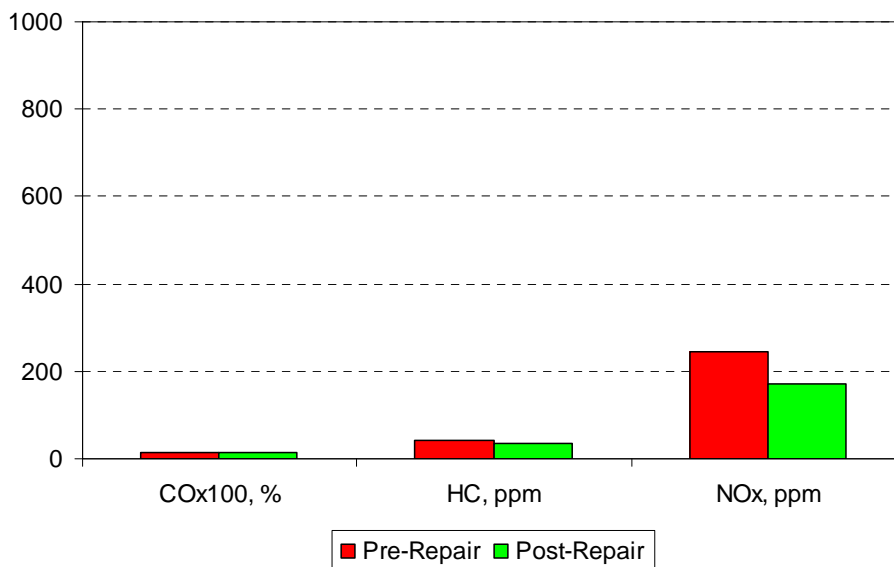


Figure 3. Pre- and post-repair average ASM emissions for the successfully-repaired 109 vehicles that initially passed the pre-repair ASM emission tests during the four TI&TU events.

Table 2 and Figures 2 and 3 show that the vehicles that passed the pre-repair ASM emission tests, although they failed the initial Smog Check inspection, had much lower initial emissions and smaller absolute and percentage emission reductions after successful repairs than the vehicles that initially failed the emissions portion at the Smog Check repair shops.

COMPARISON WITH THE 1995 CALIFORNIA I/M PILOT PROGRAM

In 1995, the California Air Resources Board tested a set of more than 600 vehicles using the Federal Test Procedure (FTP), IM240, ASM 5015, ASM2525, and two-speed idle tests using the BAR90 analyzer. In that unique study, the vehicles that failed the IM240 or the ASM test were repaired according to emissions criteria using the test that they failed. BAR-employed technicians repaired the failing vehicles, and their pre- and post-repair emissions data were collected at State of California-operated facilities. The California I/M Pilot Study provided the maximum possible repair benefit obtainable in an inspection and maintenance (I/M) program, as the mechanics were employed by the State, and their performance was monitored in a centralized I/M program format with no owner intervention. The emissions reductions obtained in the Valley CAN 2006 Visalia and 2007 Merced, Fresno, and Modesto TI&TU programs are compared with those from the California Pilot Program in Table 3.

Table 3. Pre- and post-repair emissions data from the four previous TI&TU Programs, the combined 2006 Visalia and 2007 Merced, Fresno, and Modesto TI&TU Programs, and the 1995 California I/M Pilot Program.

Program	Pre-/Post-Repair Ave. ASM Emissions			Percent Reduction		
	CO, %	HC, ppm	NOx, ppm	CO	HC	NOx
Fresno TI&TU 2005	1.39/0.09	131/46	710/335	94	65	53
Bakersfield TI&TU 2006	1.68/0.27	210/67	923/333	84	69	64
Stockton TI&TU 2006	0.98/0.18	127/51	666/221	82	60	67
Arvin TI&TU 2007	1.53/0.20	140/57	602/249	87	59	59
2006 Visalia and 2007 Merced, Fresno, and Modesto TI&TU Programs						
Failed Pre-Repair ASM Emissions	1.26/0.13	177/45	972/244	90	75	75
Passed Pre-Repair ASM Emissions	0.12/0.14	40/35	244/171	-10	13	30
CA I/M Pilot Program 1995	1.36/0.22	160/50	884/419	84	69	52

Although there is a 10-12 year difference and vehicle model years/technologies are different between the Valley CAN and California I/M Pilot programs, comparisons between pre- and post-repair emissions levels, along with percent emission reductions, are quite similar. However, the emission reductions from the vehicles that failed the pre-repair ASM emissions tests from the four city TI&TU events described in this report are larger than those obtained in the government-run California I/M Pilot Program.

COSTS OF EMISSION REDUCTIONS

Using statistical relationships derived from the California I/M Pilot Study, where regression relationships were calculated between ASM emission reductions and corresponding FTP data, it is possible to derive rough approximations of tons/year of emission reductions from this Program. Although there is scatter among the different emission test types regarding emission reduction relationships, we used these statistical relationships to estimate total emission reductions for the 211-vehicle fleet that initially failed the emissions portion of the initial Smog Check inspection at the repair shops, assuming that the repairs are effective for 10,000 miles. Estimated reductions would be different if the duration of repairs differs from the 10,000-mile assumption for repair effectiveness. We did not calculate the emission changes and associated costs for the 109 vehicles that passed the ASM emission tests but failed the initial Smog Check inspection, because the

repairs this portion of the successfully-repaired vehicles for the combined 4-city data set actually had an increase in CO emissions. These estimates are provided in Table 4. These reductions may be significantly different from those obtained in other programs.

Table 4. Emission reductions from the 211 successfully-repaired vehicles, assuming repair effectiveness for 10,000 miles.

Emission Reductions	CO	HC	NOx
Pounds per vehicle	475	48	29
Pounds from 211 vehicles	100,124	10,175	6,200
Tons from 211 vehicles	50.1	5.09	3.10

The 211 vehicles were repaired according to Smog Check emissions criteria at a total cost of \$121,044, or an average cost of \$574 per vehicle. Because it is not possible to apportion the repair types to specific emission reductions, we can provide two calculations in terms of dollars/ton for the combined 4-city TI&TU Program effectiveness. If we sum the pollutants CO + HC + NO_x, the cost-effectiveness of the program is \$2078/ton for exhaust emission reductions. The cost-effectiveness for HC + NO_x emissions combined is \$14,784/ton. These costs also include the cost of the Smog Check inspection. Because Smog Check repairs also include those that reduce evaporative or nontailpipe HC, these costs are upper limit costs for the three pollutants. If evaporative or nontailpipe HC emission reductions had been measured in this program, the true cost-effectiveness values would be less than the ones shown here. Because there was no testing for particulate matter (PM) exhaust emissions, it is not possible to calculate PM emission reductions that were obtained in this program.

The emission reductions obtained from the vehicles that initially passed the ASM emissions testing portion of the Smog Check inspection at the repair shops were very small (Table 3 and Figure 3). Net average CO emissions after repairs increased by 0.02%, and HC and NO_x emissions decreased by only 5 and 73 ppm, respectively, so the dollar-per-ton emission reductions for this portion of the successfully repaired vehicles are at least an order of magnitude higher than the reductions obtained from the 211 vehicles that initially failed the ASM emission tests prior to repairs.

GROSS-POLLUTING VEHICLES

The Bureau of Automotive Repair has adopted criteria for vehicles tested in the Smog Check Program for determining whether tested vehicles can be categorized as gross high polluters. The gross emitter cutpoints for CO, HC, and NO_x differ by vehicle model year groups, with more lenient (higher) emissions cutpoints for older vehicles and tighter (lower) emissions cutpoints for newer model year vehicles. Table 5 summarizes the vehicles identified as gross polluters by testing outcomes from the four TI&TU events.

Table 5. Gross-polluting vehicles by vehicle category from the four TI&TU events.

Vehicle Class	Number	Percent
Failed ASM Emissions and Repaired, n = 211	62	29
Passed ASM Emissions and Repaired, n = 109	0	0
Partial repairs/Left program, n = 88	45	51
Not testable, n = 20	Data not available	- - -
All others, n = 113	>5	>4

Gross polluters were identified in each of the categories except those that initially passed the ASM emissions-testing portion of the Smog Check inspection at the repair facilities. Notable is the much higher fraction of high emitters found in the group of 88 vehicles that were only partially repaired. From Table 2, we also observe that the emissions of this group were higher on average than any of the other vehicle categories, so this is a group that merits further attention regarding potential for emission reductions. It is possible that the “not testable” group of vehicles had a significant number of gross polluters, but there are no emissions data available from this category. Data were incomplete for some of the vehicles in the “all others” category, so the number of gross polluters in this group is a lower-limit value.

FRESNO 2007 TI&TU EVENT DATA

Additional effort was placed on analyzing data collected during the Fresno 2007 TI&TU event held on September 15. On that day 351 vehicles were tested for tailpipe CO and HC emissions using the portable BAR analyzer. Owners of 229 vehicles failed the emissions inspection at the event, and 171 vehicles began the repair process at the designated Gold Shield Certified smog repair shop. Figure 4 shows the model year distribution of vehicles that participated in the Fresno event. The average model year of vehicles participating in the Fresno 2007 event was 1992; the median model year was 1993.

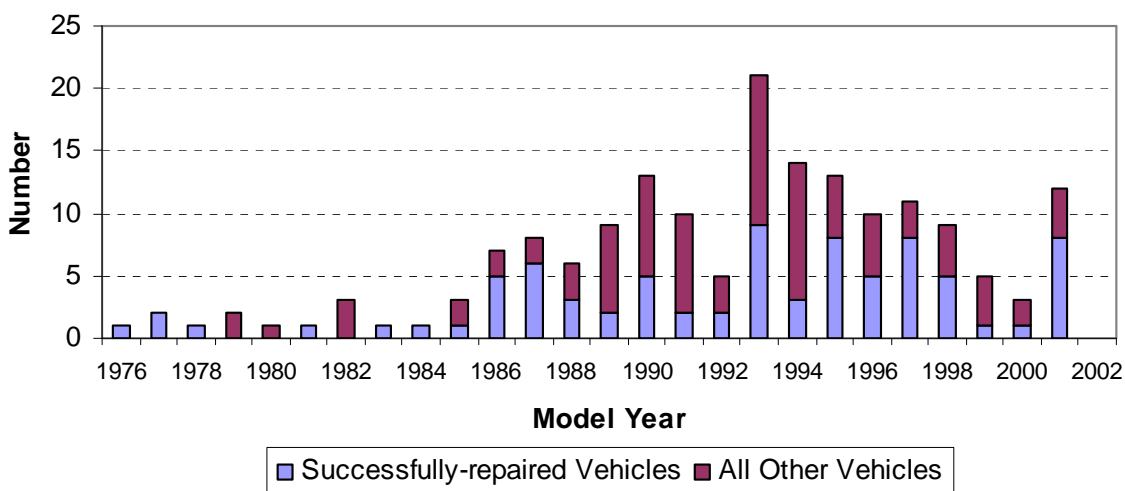


Figure 4. Model year distribution of vehicles participating in the Fresno 2007 TI&TU event.

We accessed the BAR Smog Check inspection records of the vehicles that participated in the Fresno event to find out how many days prior to the September 15, 2007 event the vehicles had received their most recent Smog Check inspection. The data are shown in 30-day intervals prior to the event in Figure 5.

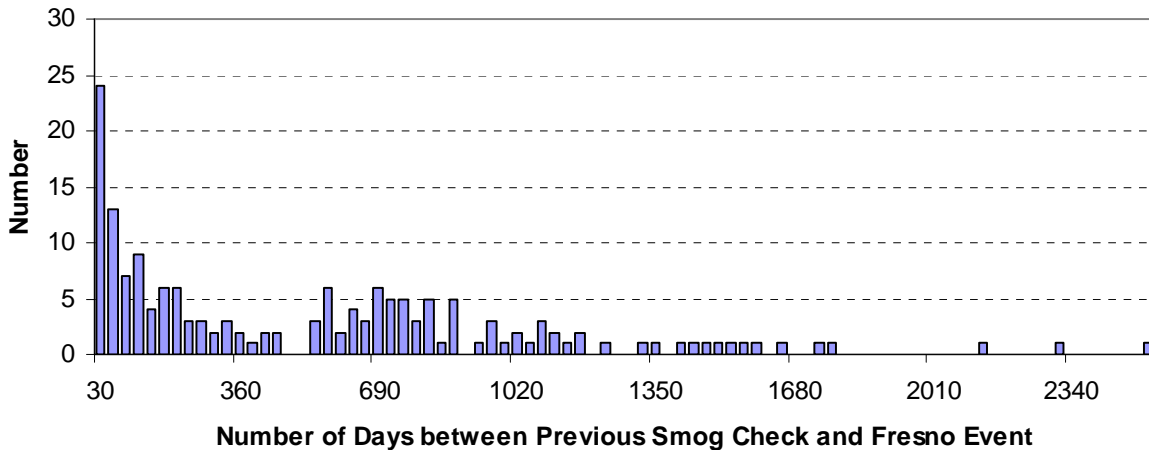


Figure 5. Interval in days between prior Smog Check inspection and Fresno 2007 event on September 15, 2006.

Twenty-four (14%) of the vehicles had received a Smog Check inspection within 30 days prior to the September 15, 2007 event; another 13 (8%) had been tested in the 30-60 day interval prior to the event. The minimum interval was 1 day; the maximum interval was 2520 days.

We also accessed the California Department of Motor Vehicle (DMV) data base to find out how many vehicles were currently registered according to DMV records at the time of the event, and also using Carl Moyer criteria, how many were eligible to participate in the Carl Moyer program. The data according to vehicle category are provided in Table 6.

Table 6. Vehicle Registration Status and Moyer Program Eligibility

Vehicle Category	Currently Registered Number/Percent	Not Moyer Eligible Number/Percent
Successfully repaired, n = 82		
Failed ASM Emissions and repaired, n = 57	17/30%	32/56%
Passed ASM Emissions and repaired, n = 25	7/28%	14/56%
Partial repairs/Left program, n = 32	11/34%	25/78%
No NOx requirements, n = 7*	3/43%	4/57%
Not testable, n = 17	4/24%	15/88%
Incomplete Data, n = 9	4/44%	7/78%
Vehicle passed Smog Check = 25	9/36%	16/64%

*Data incomplete and/or questionable for these vehicles.

For the entire Fresno 2007 TI&TU event, only 32% of the vehicles were currently registered on the day of the event according to DMV records. At least 66% of the Fresno vehicles do not appear to be Moyer eligible. To be eligible for participation in the Moyer program, a vehicle had to

participate in the Fresno event greater than 90 days prior to its regularly scheduled Smog Check inspection. Other criteria for Moyer eligibility could not be evaluated, such as at least two years' continuous registration in the air basin and gross vehicle weight criteria.

SUMMARY

The Valley CAN Tune In & Tune Up events were successfully conducted in the cities of Visalia, Merced, Fresno, and Modesto between October 2006 and October 2007. There were 1124 motorists who brought their vehicles to the four events to participate in the Program. Two-thirds of the vehicles were identified by remote sensing device (Visalia) or the two-speed idle test (Merced, Fresno, and Modesto) as high emitters. Nearly half (542) of those who came to the events brought their vehicles to participating Gold Shield Certified smog shops for repairs, with the assistance of \$500 repair vouchers provided by the Program sponsors. The total spent on Smog Check inspections and repairs for the four cities was \$223,232, with \$40,206 of that amount spent on repairs directly by vehicle owners.

There were 320 vehicles that were successfully repaired according to Smog Check program criteria, at an average cost of \$547 per vehicle. Two-thirds of the vehicles (211) that entered the repair program failed the emissions portion of the Smog Check inspection, while 109 failed for reasons other than emissions. The average repair cost for the vehicles that failed the emissions test was \$574, and those vehicles' CO, HC, and NOx emissions were reduced by 90, 75, and 75%, respectively. For the remaining 109 vehicles that failed the Smog Check inspection but did not fail for emissions, their average repair cost was \$496. CO emissions increased from those repaired vehicles by 10%, while HC and NOx emissions decreased by 13% and 30%, respectively. Although those 109 vehicles were successfully repaired according to Smog Check criteria, their emission changes were small.

The owners of 88 participating vehicles chose not to have their vehicles completely repaired according to Smog Check inspection criteria for a variety of reasons. The average pre-repair emissions were highest for this group of vehicles, so a significant emissions benefit was lost from those vehicles. Eleven percent of the vehicles that failed the emissions/inspection on the day of the TI&TU event passed the Smog Check inspection at the repair shops.

Large emission reductions were obtained from the effectively-repaired 211 vehicles that failed the emissions portion of the Smog Check inspection; their emission reductions were larger than those obtained from repaired vehicles in the 1995 California I/M Pilot Program. If each of these vehicles was driven 10,000 miles per year and the repairs lasted for 10,000 miles, each vehicle's emissions would be reduced by a total of 475, 48, and 29 pounds per year of CO, HC, and NOx, respectively. In a one-year period, the 211 successfully-repaired vehicles' emissions would be reduced by 50, 5.1, and 3.1 tons of CO, HC, and NOx, respectively.

The cost-effectiveness of the 211 successfully-repaired vehicles in the four-city Tune In & Tune Up Program was \$2078/ton for the sum of carbon monoxide, exhaust hydrocarbons, and nitrogen oxide emissions. For exhaust hydrocarbons and nitrogen oxides combined, the cost of emission reductions was \$14,784/ton. These are upper-limit values, because reductions of evaporative or nontailpipe hydrocarbons emissions obtained by performing Smog Check repairs were not measured in this program. Additional program benefit would have been obtained if all participating vehicles had been completely repaired.

ACKNOWLEDGMENTS

We thank the Valley CAN Program for overall guidance and financial support of the Tune In & Tune Up events. We also thank the California State Bureau of Automotive Repair staff for operating the emissions test used to identify high-emitting vehicles in this study, Roger Teschner from the Advanced Transportation Technology and Energy Initiative (ATTEi) at Fresno City College, and the automotive students and instructors from The College of the Sequoias in Visalia, Merced Community College, Fresno City College, and Modesto Junior College. We acknowledge Mary Teschner for creating the initial databases for the vehicles that participated in each TI&TU event and Cynthia Stover who was instrumental in providing key data. The repair shops that participated in the TI&TU events in the four cities are: California Smog and Discount Muffler in Visalia, Performance Auto Repair and Advanced Auto Repair in Merced, A-1 Auto Electric in Fresno, and Walker's Automotive and Dan's Auto Repair in Modesto.